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SUMMARY

The present study examined whether parental involvement in their adolescents' lives is associated with adolescent smoking in a vocational school setting when controlling for socioeconomic background and parental smoking. The study was conducted in spring 2013 and involved 34,776 Finnish vocational school students (mean age 17.6 years). The data were analyzed using multinomial regression. The results showed that lower parental involvement was significantly associated with adolescent daily smoking in both genders and with occasional smoking in girls. Parental daily smoking predicted adolescent daily smoking, and this association was also seen for those adolescents whose mother and father had quit smoking. Furthermore, our results indicate that mothers' smoking may be more influential on adolescents' smoking than fathers' smoking. Multivariate analysis showed that living in a nuclear family or alternately with both parents in two homes decreased daily smoking in both genders compared to living in other family arrangements.

INTRODUCTION

Cigarette smoking is usually initiated in adolescence, and experimenting with cigarettes frequently develops into regular smoking. Tobacco use often starts in response to emotional distress, which then becomes exacerbated over time (McDermott, Dobson, & Owen, 2006; Orlando, Ellickson, & Jinnett, 2001). Research has shown that smoking is associated with other health risk behavior in adolescence, such as alcohol and other substance use (Mathers, Toumbourou, Catalano, Williams, & Patton, 2006; O'Loughlin, Dugas, O'Loughlin, Karp, & Sylvestre, 2014; Piko & Balázs, 2012) and a low level of physical activity (Kauranen, 2013; Nieminen, 2015). Associations have also been established with lower academic achievement (Pennanen, Vartiainen, & Haukkala, 2012; Vartiainen et al., 2007), bullying (Luk, Wang, & Simons-Morton, 2012), and truancy (Barreto et al., 2012; Vaughn, Maynard, Salas-Wright, Perron, & Abdon, 2013). Poor health choices in adolescence have major public health implications and lead to health inequality in adulthood (World Health Organization, 2015).

Family and parental factors influence various health-related behaviors such as smoking (Johnson, McBride, Hopkins, & Pepper, 2014; Piko & Balázs, 2012). Family bonding, good family management (de Araujo, Loukas, & Gottlieb, 2011; Rainio, 2009), and parents' negative reactions toward adolescent smoking (Barreto et al., 2012; Mahabee-Gittens, Xiao, Gordon, & Khoury, 2012) have an important role in reducing the onset of daily smoking in adolescence. A strong parent-child relationship where adolescents talk first with their parents about serious problems is protective against established smoking (Distefan, Gilpin, Choi, & Pierce, 1998).

There is strong evidence that socioeconomic family factors such as lower parental education, lower family income and especially a household structure other than nuclear family (Bolte & Fromme, H for the GME Study Group, 2009; Fergusson, Horwood, Boden J., & Jenkin, 2007; Moore & Littlecott, 2015) predict adolescent smoking. Parental smoking is associated with adolescent smoking (Fröjd, Kaltiala-Heino, & Rimpelä, 2007; Ruokolainen, Ollila, & Heloma, 2013), and there is also some evidence that intergenerational smoking transmission is more common within gender: mothers' smoking is more closely associated with girls' smoking and fathers' smoking with boys' smoking (Barreto et al., 2012; Gilman et al., 2009).

The WHO (2016) has been estimated that there are one billion smokers worldwide. In Finland the typical age range for experimenting with tobacco is from 13 to 16 years. According to the latest Adolescent Health and Lifestyle Survey (2015), 12% of Finnish boys and girls aged 14–18 smoke daily. By comparison some 15% of young Australians aged 15–24 were smokers in 2010 (WHO 2015). Although Finland has had some success with its efforts to reduce tobacco use in the past decade, smoking rates among adolescents studying for a specific vocation are much higher than among high school students. In 2013 the proportion of daily smokers among Finnish high school was 8%, compared with 36% among vocational school students (National Institute for Health and Welfare, 2016). This huge difference has received attention even internationally (Huisman, van de Werfhorst, & Monshouwer, 2012a; Lee, Goldstein, Klein, Ranney, & Carver, 2012; Loukas, Murphy, & Gottlieb, 2008) TAFE students' smoking has not been studied recently but that smoking rates tend to be high, and similar to those for unemployed youth (Bonevski, Paul, Walsh, Bryant, & Lecathelinais, 2011).

The Finnish education system begins with a nine-year compulsory basic education for the whole age cohort. Beyond this first step 95.5% of school-leavers continue either in upper secondary schools i.e. high schools (54.5%) or in initial vocational education and training (38.5%), or in additional voluntary basic education (2.5%). The aim of vocational education and training is to improve the skills of the work force and to provide students with the skills and knowledge they will need in specific vocations. The largest fields are technology and transport, business and administration, and health and social services (Ministry of Education and Culture, Finland, 2016).

Some research has been undertaken into smoking prevention and cessation programs among post-compulsory school students (Lee et al., 2012; Loukas et al., 2008), but there are only few recent studies of family factors related to adolescent smoking in upper secondary or vocational school settings. It is known that adolescents' smoking behavior is associated with family connectedness (Piko & Balázs, 2012; Wen, Van Duker, & Olson, 2009). Internationally, more than one-third of vocational students smoke cigarettes daily, and therefore it is crucial to examine the associations between family involvement and vocational students' life and their smoking behavior. Parents may think that adolescents studying for a specific occupation should be mature enough to cope with any difficulties without their getting involved: after all, in a year or two they will be working and earning their own income. Furthermore, there remain

unanswered questions about the predictive value of family factors for vocational students' daily smoking, occasional smoking and former smoking.

Purpose of study and hypotheses

The aim of this study is to examine the association of parental involvement and other family factors with adolescent smoking. We used a large nationally representative sample of vocational school students in order to make an interesting contribution to the literature. We test four hypotheses in the light of the information presented in the introduction:

Hypothesis 1: Fewer adolescents living in a nuclear family are daily smokers as compared to adolescents in other family types.

Hypothesis 2: The lower the level of parental education, the higher the level of adolescent daily smoking.

Hypothesis 3: The lower the level of family involvement, the higher the level of adolescent daily smoking.

Hypothesis 4: Mothers' smoking shows a closer association with girls' smoking and fathers' smoking with boys' smoking.

METHODS

Sample and procedures

Associations between parental involvement and adolescent smoking were studied using data from the School Health Promotion Study (SHP) by the National Institute for Health and Welfare in Finland. SHP is a nationwide survey conducted every other year in March-April. The target group for this study consisted of 1st and 2nd grade students from all vocational schools in Finland in 2013. A total of 34,776 students from 419 vocational schools anonymously and voluntarily completed a classroom-administered questionnaire under their teacher's supervision. SHP was approved by the ethical committee of the National Institute for Health and Welfare in 2012 and 2014. Students were informed about the study in advance and given the researchers' contact information in case they wanted to discuss any concerns they had about the study. Good scientific practice was followed throughout the research. The questionnaire can be found online at <http://www.thl.fi/fi/web/thlfi-en/research-and-expertwork/population-studies/school-health-promotion-study>.

The respondents were aged between 14 and 20 (Mean= 17.6, S.D. 0.90). Over half (55.6%) were males (n= 19336) and 44.4% females (n= 15440). To account for potential gender differences, separate analyses were conducted for boys and girls. Sample statistics of selected variables are shown in supplementary table 1. The response rate for SHP was not able to count reliably as the number of students were not inquired from the institutes but from statistics that could only give the total number of adolescents studying in vocational schools. This study was not conducted for students in their 3rd year. Vocational training is also based on long practical training periods and that was not taken into account when conducting the SHP study. However, in this secondary analysis, the rate of missing values was quite low (between 1.3%-2.4%), with one exception: missing values for parents' education were somewhat higher (mothers' education 3.6% and fathers' education 4.7%).

Measurement

Adolescent smoking

Adolescent smoking behavior was originally assessed by two questions: 1. How many cigarettes, pipefuls and cigars have you smoked altogether (none, only one, about 2-50 and over 50)? 2. Which of the following alternatives best describes your current smoking habits? (I smoke once a day or more often, I smoke once a week or more often, but not every day, I smoke less often than once a week, I have quit smoking). These adolescent smoking variables were combined into one variable with response categories: daily smokers (I smoke once a day or more often), occasional smokers (I smoke once a week or less often), those who had quit smoking (I have quit smoking) and non-smokers (I have smoked altogether only one or none).

Sociodemographic status

The following three demographic variables were used: family structure, parental education and parental unemployment. *Family structure* was assessed by asking the respondents to identify the adults with whom they lived. We subsequently coded this variable into living in a nuclear family, living with a single parent, living in a step family, living alternately with separated parents in two homes, and living in some other arrangement. *Parental education level* was assessed by asking the participants to state their mother's and father's highest level of education. The variable was categorized into three levels: low education (comprehensive or primary school), middle education (upper secondary school and/or vocational institution), and high education (university, university of applied sciences or other higher education institution). To assess *parental unemployment*, students were asked if their parents had been unemployed or laid off during the past year. The options were: neither of my parents, one of my parents and both of my parents.

Parental involvement

Parental involvement was studied using five questions measuring parent-child relationship, family connectedness, and parental monitoring. All these questions were dichotomized into two categories. The first category (coded as 1) referred to a high level of parental involvement and the second category (coded as 0) to a low level or no parental involvement. The dichotomized variables were then summed up to create an involvement indicator ranging from 0 to 5, with 0 referring to no or low parental involvement and 5 to parental involvement in all five items. The dichotomization of these questions is shown in supplementary table 2.

Parental smoking

Parental smoking status was measured by the question: During your lifetime, has your father / mother (separately) smoked? The response options were: never smoked, used to but has now quit, smokes nowadays and don't know. The responses were combined into the categories daily smoker (smokes nowadays and don't know), quit smoking and non-smoker.

Data analysis

The primary research questions focused on associations between vocational school student cigarette smoking and *parental factors*. Cross-tabulation and χ^2 tests were performed for categorical variables to establish the proportion of students who smoked daily, who smoked occasionally, and who had quit smoking and those students who were non-smoking on various *family factors* (Table 1). Unadjusted (i.e. univariate; suppl. table 3) and adjusted (i.e. multivariate; table 2) multinomial logistic regression analyses were then performed to describe and test the associations between smoking and family factors. In the unadjusted model (suppl. table 3), one variable was entered at a time. In the adjusted model (table 2), all of the variables were examined at the same time. Adolescent smoking was set as a dependent variable and family factors as independent variables. Adolescents' age was set as covariate. Daily smokers, occasional smokers and those who had quit smoking were compared to non-smokers, who were used as a reference group. To account for potential gender differences, separate analyses were conducted for girls and boys. To find out if mothers' and fathers' smoking was equally important for both boys and girls, two multivariate multinomial regression analyses with interactions were performed for the whole dataset. The first analysis included the interaction term between gender and mother's smoking, and the second analysis the interaction term between gender and father's smoking. All other independent variables were also included in the models.

The statistical analyses were conducted using IBM (Armonk, NY) SPSS statistics 23. Results from the multinomial regression analyses are presented as odds ratios (ORs) and their 95% confidence intervals. The level of statistical significance was set at $p < 0.001$ due to the large number of respondents.

RESULTS

Adolescent smoking prevalence, gender, and age differences

Just over one-third or 36% of all vocational school students reported smoking daily. Girls were daily smokers (37%) slightly more often than boys (36%) (suppl. table 1). Girls were also occasional smokers (15%) slightly more often than boys (13%). 15% of girls and 14% of boys said they had quit smoking. One-third of girls (33%) and 38% of boys reported being non-smokers. The multivariate models indicated that age was statistically significantly associated with daily smoking (Table 2).

Are sociodemographic factors associated with adolescent smoking (H1 and H2)?

In nuclear families, 29% of girls and 30% of boys were daily smokers. Among adolescents living alternately with both biological parents in two separate homes, the proportion was 36% for both girls and boys. Girls living in a single parent family were daily smokers slightly more often (42%) than boys living in a single parent family (40%). Among adolescents living with a biological parent and his/her partner, 43% of girls and 41% of boys were daily smokers. Among adolescents with other living arrangements, girls (46%) were daily smokers less often than boys (49%) (Table 1). Family type was statistically significantly associated with girls' and boys' smoking in the multivariate model (table 2). In multivariate analysis (table 2), other living arrangements than living with a biological parent or parents increased daily and occasional smoking in both genders. In girls, other living arrangements than living in an intact family, living with a single parent, and living with a biological parent and his/her partner were also associated with being a former smoker. Living with separated biological parents in two homes was not associated with smoking either daily or occasionally in multivariate analysis.

In the univariate model (suppl. table 1), adolescents living with parents who had been unemployed or laid off during the past year reported smoking daily more often than their peers who lived with employed parents. Mother's education level showed no significant association with smoking in the univariate model (suppl. table 3), but low paternal education level was significantly associated with daily smoking in boys. In the multivariate model (table 2), unemployment and adolescent smoking did not show a statistically significant association, but girls whose mother had a medium or low level of education were daily smokers significantly less often than girls whose mothers had a university or university of applied sciences degrees. Girls were also occasional smokers less often if their mother had a low education. In fact, girls smoked more often daily when their level of education differed widely from their mothers' education.

Does parental involvement in adolescents' lives prevent smoking (H3)?

Higher overall scores of parental involvement reflected less adolescent smoking. Less than one-third of adolescents (30% of girls and 29% of boys) with very high parental involvement indicator scores were daily smokers. Among girls and boys with zero parental involvement scores, over half were daily smokers. Boys and girls with other than the highest parental involvement scores were daily smokers significantly more often than others (Suppl. table 3 and Table 2). The odds of girls' smoking occasionally were also significantly higher if they reported any other than the highest parental involvement score. This association is also seen when age, socioeconomic factors, and parental smoking were controlled for in the multivariate model (Table 2).

Is parental smoking associated with adolescent smoking (H4)?

The univariate model (suppl. table 3) shows that adolescents whose parents were smokers were more often daily smokers than those whose parents didn't smoke. This association was also seen for adolescents whose parents who had given up smoking. These associations remained in the multivariate model (table 2): mothers' smoking was associated with girls' and boys' daily smoking. Having a mother who was a former smoker was associated with girls' daily and occasional smoking, as well as with being a former smoker. Father's smoking was significantly associated with girls' and boys' daily smoking and with being a former smoker. Having a father who was a former smoker was associated with girls' and boys' daily and occasional smoking, and with boys' being a former smoker.

To find out whether mother's and father's smoking was equally important for boys and girls, two multivariate multinomial regression analyses with interactions were performed for the whole dataset. The first analysis included the main effect of gender and interaction term with gender and mother's smoking, and all other independent variables. The second analysis included the main effect of gender and interaction term with gender and father's smoking. It emerged that the interaction between gender and mother's smoking was statistically significant ($p < 0.001$), but the interaction between gender and father's smoking was not ($p = 0.023$). This suggests that there are some gender differences in the association between mother's smoking and boys' and girls' smoking, but not in the association between fathers' smoking and girls' and boys' smoking. Therefore, our hypothesis of intergender transmission was not confirmed.

DISCUSSION

The results of our study lend support to earlier findings on the relationships between parental involvement, family type, parental smoking and adolescent daily smoking. Over one-third or 36% of our vocational school students smoked cigarettes daily; this is in line with results from a study measuring adolescent smoking among trade and technical students in Texas (Loukas et al., 2008). Girls' and boys' smoking vary in different countries (Moor et al., 2015). This research

from Finland showed that girls smoked daily and occasionally and had quit smoking more often than boys. Earlier studies indicate that smoking cessation is gender-blind (Amos, Greaves, Nichter, & Bloch, 2012; Struik, O'Loughlin, Dugas, Bottorff, & O'Loughlin, 2014), but it has been reported that the reasons for giving up smoking differ: girls are more concerned about adverse aesthetic effects such as the smell of smoke on their clothes and bodies, while boys are more concerned about the impact of smoking on their fitness and sporting performance (Amos & Bostock, 2007). An earlier Finnish study (Kauranen, 2013) identified three main reasons why boys at vocational school said they smoked. First, smoking was considered to project an image of a skilled professional and to communicate social belonging. Second, smoking offers an opportunity for time-out and a chance to figure out what to do next. Finally, smoking was said to help to relax and calm you down. Technical students in Texas had similar reasons for smoking (de Araujo et al., 2011).

Socioeconomic factors

Earlier results on the associations between family socioeconomic background (SES) and adolescent smoking behavior are inconsistent. Some studies show no or slight associations (Barreto et al., 2012; Wen et al., 2009), others report that low socioeconomic status correlates with higher smoking frequencies (Bolte & Fromme, H for the GME Study Group, 2009; Fergusson et al., 2007; Moore & Littlecott, 2015). It has been shown that higher parental education and higher family income are protective against adolescent smoking, but their influences are indirect and mediated by other factors (Wen et al., 2009). It has also been found that parents smoke more often (Fergusson et al., 2007), eat family dinners together less often (Neumark-Sztainer, Wall, Fulkerson, & Larson, 2013) and family structure is more often other than a nuclear family (Bolte & Fromme, H for the GME Study Group, 2009) with low SES than with higher SES. In this study, the results of multinomial regression ran counter to our expectations and showed that girls were daily smokers less often if their mother had a lower level of education than a university or university of applied sciences degree. Girls were also occasional smokers less often if their mother had a low education. Parental unemployment showed no association with adolescent daily or occasional smoking (H2). Previous research has shown that parents of vocational school students have a lower educational level than adolescents studying in upper secondary school, but social background effects were almost fully explained by the differential enrollment of students in different institutions (Huisman et al., 2012a; Huisman, van de Werfhorst, & Monshouwer, 2012b). It is possible that girls who have mothers with a higher education need to show off and to try to fit in by smoking. Daughters who have a lower level of education than their mothers may also be at greater risk of smoking.

Extensive studies into family structure and its association with adolescent smoking have shown that adolescent smoking differs across family structures. (Brown & Rinelli, 2010; Razaz-Rahmati, Nourian, & Okoli, 2012). Also in this study adolescents living with two biological married parents are least likely to smoke, while adolescents in cohabiting stepfamilies are most likely to smoke. Those living in single parent families and married stepfamilies fall in between these groups. Adolescents living with other than their parents were most likely to smoke daily and occasionally in both genders, but the association was also apparent in girls' smoking cessation. Our results suggest that girls living in a stepfamily might be more likely to smoke daily than those living with a single parent.

Our hypothesis that adolescents living in a nuclear family are less often daily smokers than those living in other family types received only partial support as living alternately with separated parents in two homes was not associated with daily or occasional smoking in either girls or boys (H1). This is an interesting result because dual parenting is a relatively new form of family, and international results on co-parenting and its association with adolescents' smoking are scarce. In settings where adolescents have two homes and live alternately with both biological parents, parenting is particularly important to the health and well-being of children as adolescents with strong ties to both parents exhibit fewer internalizing and externalizing problems, higher grades and less acting out at school than those with weak ties to both parents (King & Sobolewski, 2006). Children with co-parenting parents have been found to feel safe and loved after divorce (Parlakian & Lerner, 2012) when both parents are still equally responsible and present. It has also been found that nonresident father involvement decreases both participation in smoking and intensity of smoking in adolescence and young adulthood (Ali & Dean, 2015).

Parental involvement

There is consistent evidence that family involvement, family monitoring and family connectedness have an inverse association with risk-taking behavior (Borawski, Ievers-Landis, Lovegreen, & Trapl, 2003) such as smoking. However, as adolescents mature, parents often change their parenting practices and allow their teens more independence (Borawski et al., 2003; McGue, Elkins, Walden, & Iacono, 2005; Piko & Balázs, 2012; Shanahan, McHale, Crouter, & Osgood, 2007). Our results indicate that parents should maintain a strong family involvement as their children grow up and transit to vocational school.

Our findings lend support to our hypothesis that parental involvement is significantly associated with

daily smoking and occasional smoking in boys and girls when controlling for age, socioeconomic factors and parental smoking (H3). In this study we formed a parental involvement indicator including the measures of parent-child relationship, parental monitoring and family connectedness.

There is evidence that a good relationship and good communication with parents are associated with lower levels of adolescent smoking (Cheney, Oman, Vesely, Aspy, & Tolma, 2015; Distefan et al., 1998; Johnson et al., 2014), whereas a low level of parental communication can be positively correlated with smoking when adolescents feel they are not so close to their parents and smoking is seen as a way to rebel against parents (Harakeh, Scholte, Vermulst, de Vries, & Engels, 2010; Wen et al., 2009). It is possible that a less than a close relationship signals a superficial level of communication or a forced format of conversation, which may become a stressor stimulating deviant behaviors in adolescents.

Earlier reports suggest that parental monitoring and knowledge of friends and whereabouts are associated with lower levels of smoking initiation and daily smoking (Johnson et al., 2014; Mahabee-Gittens et al., 2012). A reasonable amount of parental monitoring has been found to mediate peer influence and have a strong effect on adolescents' selection of friends (Mercken, Sleddens, de Vries, & Steglich, 2013; C. Wang, Hipp, Butts, Jose, & Lakon, 2016). Smoking and other substance use as well as symptoms such as depression and anxiety are more common if parents don't know the whereabouts of their adolescents and don't know their friends (Fröjd et al., 2007). Among high-risk adolescents, those who reported low parental monitoring were significantly more likely to smoke and use a variety of other substances (Shillington et al., 2005).

Previous research has shown that more frequent family meals are associated with positive outcomes in adolescents' well-being (Musick & Meier, 2012) and smoking (Distefan et al., 1998). As teens start having more hobbies and get involved in other events, dinner might be the only time of day when the family comes together. According to our study, 35% of girls and 39% of boys enjoyed a proper meal together with usually everyone at the table. Earlier studies also indicate that boys eat family meals more frequently than girls (Berge, Wall, Neumark-Sztainer, Larson, & Story, 2010). In addition to the evidence that family meals are associated with smoking and other substance use (De Clercq, Pfoertner, Elgar, Hublet, & Maes, 2014; Mure, Konu, Kivimäki, Koivisto, & Joronen, 2014), it has been reported that adolescents from low SES families eat fewer family dinners and that families with low SES might have more difficulties getting together for family meals on a regular basis (Neumark-Sztainer et al., 2013).

Parental smoking

There is an abundance of evidence that smoking parents have smoking adolescents, and according to several studies smoking mothers have smoking daughters and smoking fathers have smoking sons (Barreto et al., 2012; Gilman et al., 2009). We also found that maternal and paternal smoking were related to the risk of adolescent smoking, and that this association remained even if parents had quit smoking. Our results indicate that maternal daily smoking is differently associated with girls' and boys' smoking, but the association of fathers' smoking with adolescents' smoking is similar in both genders. According to an earlier study (Gilman et al., 2009), children whose parents had quit smoking are not more likely to begin smoking than children whose parents had never smoked. The same study also found that intergenerational transmission is more likely before than after age 13. Our respondents were older, and we were not able to identify the age of the children at the time that their parents had quit smoking. Our results also showed that occasional adolescent smoking was significantly more common even if the father had given up smoking, but if the mother had quit smoking it implicated only daughter's occasional smoking.

Earlier studies have found that the intergenerational transmission of smoking is mediated by several factors. Smoking parents have more lenient attitudes toward smoking, have less smoking-related rules at home (Pennanen et al., 2012) and have less smoking-related conversations (Y. Wang, Krishnakumar, & Narine, 2014). A lower level of parental control (Wen et al., 2009) and the availability of cigarettes in the house have been found to be associated with adolescent smoking (Abar, Jackson, Colby, & Barnett, 2014; Rainio, 2009). Smoking parents also have difficulty maintaining anti-smoking practices as adolescents get older (Pennanen et al., 2012).

The main goal of the present paper was to examine the role of parental involvement and other family factors in the life of adolescents studying for a specific vocation. Although there is an extensive literature on the determinants of smoking in adolescence, studies focusing on adolescent smoking in vocational school settings are scarce. It is possible that adolescents who are set to earn their own living in couple of years' time are viewed as young adults rather than adolescents and therefore tend to be excluded from adolescent studies. Using data from a major national survey and analyzing this data with multinomial regression models, this study makes a unique contribution to smoking research as we tested variables of social involvement within the family and other family factors with daily smoking, occasional smoking, and former smoking in adolescents in a vocational school setting.

LIMITATIONS

There are some limitations in this study that should be noted when interpreting our findings. Despite the many advantages of secondary analysis, including the large sample size, the method does have some inherent limitations, most notably the fact that the researchers are limited to the data collected during the original data collection. Primary data set was insufficient due to missing data and could not be estimated reliably. However, strength of the primary data collection was that it was obtained from every vocational institute in Finland. In this secondary analysis rate of missing values was low (between 1.3%-4.7%). Because the information was gathered by self-report, we cannot ignore the possibility of under- or over-reporting (Brenner, Billy, & Grady, 2003). In this study, we did not validate smoking by biological indicators because of the large sample sizes. However, self-reports have been shown to be reliable when conducted under optimized measurement conditions, ensuring anonymity and when using various questions (Brenner et al., 2003; Caraballo, Giovino, & Pechacek, 2004). It needs to be noted that causal conclusions cannot be drawn from these cross-sectional survey data. Further research is needed using longitudinal data to determine the temporal relationship between parental involvement and adolescent smoking.

CONCLUSION

As far as we know this is the first study to examine adolescent smoking behavior related to family involvement in adolescents who are studying for a specific occupation. It sheds further light on the role of parental involvement in their adolescents' lives and on adolescent daily, occasional and former smoking in a large sample of vocational school students. Our findings highlight the importance of parental involvement as a strong protective factor against adolescent smoking and speak against more lenient parenting practices. We recommend that health care services and schools advocate strong parental involvement in their adolescents' lives.

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Table 1. Cross tabulation

	GIRLS									BOYS								
	smokes daily		occasionally		has quit smoking		non-smoker		P*	smokes daily		occasionally		has quit smoking		non-smoker		P*
	N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%	
Family type									<0.001									<0.001
nuclear family	1961	29%	1078	16%	921	14%	2718	41%		2988	30%	1285	13%	1426	14%	4216	43%	
shared custody	229	36%	112	18%	94	15%	202	32%		506	36%	192	14%	191	14%	530	37%	
single parent	965	42%	300	13%	358	15%	695	30%		1180	40%	350	12%	380	13%	1012	35%	
step family	611	43%	202	14%	207	15%	388	28%		680	41%	201	12%	239	15%	527	32%	
other	1760	46%	526	14%	656	17%	892	23%		947	49%	229	12%	258	13%	510	26%	
Mother's education level									0.004									<0.001
low	888	40%	293	13%	321	14%	734	33%		963	40%	260	11%	269	11%	909	38%	
medium	3476	37%	1429	15%	1434	15%	3180	33%		3836	35%	1424	13%	1601	15%	4196	38%	
high	1117	38%	477	16%	465	16%	911	31%		1412	34%	543	13%	590	14%	1573	38%	
Father's education level									0.005									<0.001
low	1330	40%	465	14%	479	14%	1056	32%		1428	41%	385	11%	431	12%	1258	36%	
medium	3312	37%	1357	15%	1389	15%	2947	33%		3639	34%	1364	13%	1470	14%	4133	39%	
high	770	35%	356	16%	325	15%	746	34%		1082	33%	468	14%	533	16%	1219	37%	
Parental unemployment									<0.001									<0.001
neither parent	3325	35%	1482	16%	1452	15%	3325	35%		3951	34%	1525	13%	1673	14%	4617	39%	
one parent	1865	41%	634	14%	678	15%	1371	30%		1959	38%	625	12%	703	14%	1865	36%	
both parents	341	46%	99	13%	105	14%	205	27%		392	43%	103	11%	110	12%	309	34%	
Help from parents									<0.001									<0.001
gets help	4090	36%	1690	15%	1722	15%	3864	34%		5134	35%	1855	13%	2073	14%	5632	38%	
doesn't get help	1452	42%	521	15%	484	14%	981	29%		1275	40%	408	13%	409	13%	1134	35%	
Dialogue with parent									<0.001									<0.001
hardly ever	480	41%	178	15%	168	14%	348	30%		569	43%	158	12%	171	13%	429	32%	
once in a while	1704	37%	754	17%	670	15%	1448	32%		2018	37%	728	13%	766	14%	1943	36%	
often	3429	37%	1317	14%	1416	15%	3159	34%		3935	34%	1425	12%	1606	14%	4576	40%	
Family dinner									<0.001									<0.001
family dinners	1656	31%	723	14%	807	15%	2081	40%		2128	31%	850	12%	988	14%	3009	43%	
no family dinners	3871	40%	1494	16%	1421	15%	2820	29%		4195	39%	1389	13%	1488	14%	3772	35%	
Parental knowledge of friends									<0.001									<0.001
Parents don't know	524	38%	212	15%	212	15%	440	32%		873	34%	268	11%	374	15%	1027	40%	

Only father knows	156	47%	49	15%	38	12%	88	27%		310	42%	113	15%	97	13%	215	29%	
Only mother knows	1628	44%	497	13%	581	16%	1009	27%		1133	43%	297	11%	351	13%	845	32%	
Both know	3235	34%	1462	15%	1411	15%	3384	36%		4016	34%	1583	13%	1674	14%	4721	39%	
Weekend whereabouts									<0.001									<0.001
parents know	2713	32%	1110	13%	1282	15%	3498	41%		2687	29%	1020	11%	1224	13%	4399	47%	
do not know	2822	45%	1109	18%	955	15%	1413	22%		3635	43%	1247	15%	1264	15%	2399	28%	
Parental involvement									<0.001									<0.001
No involvement	77	51%	25	17%	25	17%	24	16%		86	51%	18	11%	26	16%	38	23%	
Very low involvement	257	45%	94	17%	73	13%	144	25%		280	44%	69	11%	98	15%	193	30%	
Rather low involvement	671	41%	263	16%	221	14%	465	29%		715	39%	230	13%	255	14%	631	35%	
Rather high involvement	1399	40%	542	15%	541	15%	1029	29%		1642	39%	541	13%	537	13%	1444	35%	
High involvement	2124	37%	867	15%	868	15%	1893	33%		2255	35%	868	13%	908	14%	2456	38%	
Very high involvement	860	30%	363	13%	437	15%	1197	42%		1082	29%	436	12%	556	15%	1718	45%	
Mother's smoking									<0.001									<0.001
daily smoker	2341	50%	555	12%	625	14%	1120	24%		2424	46%	533	10%	614	12%	1653	3%	
has quit smoking	1312	43%	484	16%	456	15%	787	26%		1610	42%	490	13%	521	14%	1174	31%	
non-smoker	1960	27%	1210	16%	1175	16%	3048	41%		2488	27%	1288	14%	1408	15%	4121	44%	
Father's smoking									<0.001									<0.001
daily smoker	2341	50%	555	12%	625	14%	1120	24%		2424	46%	533	10%	614	12%	1653	32%	
has quit smoking	1312	43%	484	16%	456	15%	787	26%		1610	42%	490	13%	521	14%	1174	31%	
non-smoker	1960	27%	1210	16%	1173	16%	3048	41%		2488	27%	1288	14%	1408	15%	4121	44%	

*) = Chi Square

Table 2. Adjusted odd ratios (and 95% confidence intervals) in the multinomial logistic regression of smoking on family factors.

Table 2. Adjusted odd ratios (and 95% confidence intervals) in the multinomial logistic regression of smoking on family factors.

	GIRLS									BOYS								
	smokes daily OR	95% CI	P	smokes OR	occasionally 95% CI	P	has quit smoking OR	95% CI	P	smokes daily OR	95% CI	P	smokes OR	occasionally 95% CI	P	has quit smoking OR	95% CI	P
Age	0.92	0.88-0.96	<0.001	0.92	0.87-0.97	0.003	0.96	0.91-1.02	0.207	1.11	1.06-1.16	<0.001	1.03	0.97-1.10	0.301	1.02	0.96-1.09	0.473
Family type																		
Other type	2.36	2.11-2.64	<0.001	1.43	1.24-1.65	<0.001	2.07	1.80-2.38	<0.001	2.00	1.75-2.29	<0.001	1.41	1.17-1.70	<0.001	1.35	1.12-1.62	0.001
Step family	1.62	1.39-1.88	<0.001	1.17	0.96-1.43	0.110	1.42	1.20-1.73	<0.001	1.40	1.22-1.60	<0.001	1.17	0.97-1.40	0.057	1.29	1.08-1.53	0.005
Single parent	1.50	1.34-1.70	<0.001	1.01	0.86-1.20	0.866	1.40	1.20-1.64	<0.001	1.30	1.16-1.44	<0.001	1.07	0.92-1.24	0.157	1.06	0.92-1.23	0.433
Co-parenting/dual																		
residence Intact	1.23 1	1.00-1.53	0.055	1.26 1	0.97-1.62	0.080	1.32 1	1.01-1.71	0.043	1.13 1	0.98-1.30	0.093	1.09 1	0.91-1.32	0.355	0.97 1	0.81-1.17	0.757
Mother's education																		
Low	0.65	0.56-0.77	<0.001	0.69	0.56-0.84	<0.001	0.74	0.61-0.91	0.004	0.86	0.74-0.99	0.038	0.87	0.71-1.07	0.181	0.87	0.71-1.06	0.166
Medium	0.75	0.67-0.84	<0.001	0.83	0.72-1.96	0.013	0.82	0.71-0.95	0.007	0.96	0.87-1.05	0.363	1.03	0.91-1.18	0.623	1.10	0.97-1.25	0.123
High	1			1			1			1			1			1		
Father's education																		
Low	1.06	0.90-1.23	0.424	1.02	0.84-1.24	0.854	1.02	0.88-1.30	0.524	1.02	0.89-1.17	0.746	0.75	0.62-0.91	0.003	0.78	0.65-0.94	0.007
Medium	0.99	0.87-1.13	0.666	0.99	0.72-1.16	0.935	1.09	0.93-1.28	0.299	0.86	0.77-0.96	0.005	0.81	0.71-0.93	0.003	0.76	0.97-1.25	<0.001
High	1			1			1			1			1			1		
Parental unemployment																		
One parent	1.16	0.95-1.42	0.145	1.01	0.77-1.31	0.966	1.3	0.80-1.33	0.819	1.07	0.90-1.28	0.435	1.04	0.81-1.33	0.758	0.99	0.78-1.27	0.958
Both parents	1.11	1.01-1.21	0.036	1.01	0.89-1.13	0.908	1.01	0.93-1.28	0.832	0.99	0.91-1.08	0.896	1.00	0.89-1.12	0.943	1.03	0.92-1.15	0.668
Neither parent	1			1			1						1			1		
Parental involvement																		
No involvement	2.90	1.79-4.70	<0.001	2.90	1.62-5.19	<0.001	1.90	1.06-3.42	0.033	2.44	1.59-3.72	<0.001	1.54	0.82-2.87	0.176	1.99	1.16-3.41	0.012
Very low involvement	2.04	1.61-2.59	<0.001	2.16	1.61-2.89	<0.001	1.22	0.90-1.67	0.206	1.76	1.41-2.18	<0.001	1.38	1.01-1.87	0.040	1.48	1.12-1.96	0.006
Rather low involvement	1.70	1.45-1.99	<0.001	1.74	1.42-2.12	<0.001	1.19	0.97-1.45	0.095	1.47	1.28-1.69	<0.001	1.34	1.11-1.62	0.003	1.21	1.00-1.44	0.045
Rather high involvement	1.75	1.54-1.98	<0.001	1.75	1.49-2.06	<0.001	1.39	1.19-1.60	<0.001	1.69	1.51-1.88	<0.001	1.44	1.24-1.68	<0.001	1.17	1.02-1.35	0.030
High involvement	1.49	1.33-1.67	<0.001	1.56	1.29-1.73	<0.001	1.24	1.08-1.43	0.002	1.36	1.23-1.51	<0.001	1.36	1.19-1.56	<0.001	1.14	1.00-1.29	0.050
Very high involvement	1			1			1			1			1			1		
Mother's smoking																		
Smokes nowadays	2.46	2.21-2.73	<0.001	1.15	1.00-1.33	0.048	1.28	1.12-1.47	<0.001	1.75	1.59-1.93	<0.001	0.89	0.78-1.03	0.108	0.97	0.85-1.11	0.656
Used to smoke but has now quit	2.05 1	1.83-2.30	<0.001	1.43 1	1.24-1.65	<0.001	1.35 1	1.17-1.56	<0.001	1.68 1	1.52-1.87	<0.001	1.17 1	1.02-1.34	0.022	1.16 1	1.01-1.32	0.034
Never smoked																		
Father's smoking																		
Smokes nowadays	1.74	1.56-1.94	<0.001	1.23	1.07-1.40	0.003	1.30	1.14-1.49	<0.001	2.10	1.90-2.32	<0.001	1.26	1.11-1.44	0.001	1.28	1.12-1.45	<0.001
Used to smoke but has now quit	1.59 1	1.42-1.78	<0.001	1.28 1	1.12-1.47	<0.001	1.23 1	1.07-1.41	0.003	2.05 1	1.85-2.26	<0.001	1.55 1	1.36-1.76	<0.001	1.47 1	1.30-1.67	<0.001
Never smoked																		

Supplementary table 1. Sample statistics of selected variables

Variables	Girls		Boys		p*
	N	%	N	%	
Family type					<0.001
Intact	6847	45.0	10359	55.2	
Co-parenting/dual residence	662	4.3	1491	7.9	
Single parent	2364	15.5	3127	16.7	
Step family	1437	9.4	1712	9.1	
Other type	3914	25.7	2080	11.1	
Mother's education level					<0.001
Comprehensive school or primary school or no education	2321	15.4	2655	14.4	
Upper secondary school or vocational education	6550	43.5	7617	41.2	
Occupational studies in addition to upper secondary school or vocational education	3166	21.0	3917	21.2	
University, university of applied sciences or other higher education	3028	20.1	4279	23.2	
Father's education level					<0.001
Comprehensive school or primary school or no education	3419	23.0	3761	20.6	
Upper secondary school or vocational education	6953	46.8	8151	44.6	
Occupational studies in addition to upper secondary school or vocational education	2248	15.1	2933	16.0	
University, university of applied sciences or other higher education	2243	15.1	3450	18.9	
Parental unemployment last year					0.016
Neither parent	9812	64.6	12319	65.7	
One parent	4643	30.5	5452	29.1	
Both parents	771	5.1	982	5.2	
Help from parents if facing difficulties with school or school work					<0.001
Whenever I need	7140	47.1	9568	50.6	
On most occasions	4488	29.6	5876	31.1	
Rarely	2009	13.3	1962	10.4	
Hardly ever	1521	10.0	1485	7.9	
Parents know most of adolescent's friends					<0.001
Both know	9711	63.6	12549	66.6	
Only father	351	2.3	857	4.8	
Only mother	3801	24.9	2738	14.5	
Neither parent	1415	9.3	2684	14.3	
Parents know whereabouts on weekends					<0.001
Yes, always	8800	57.7	9786	52.1	
Yes, sometimes	5296	34.7	7391	39.3	
Most of the time they don't know	1153	7.6	1621	8.6	
Adolescent can discuss personal issues with parents					0.801
Often	4898	32.1	5631	29.9	
Fairly often	4452	29.2	5950	31.6	
Once in a while	4702	30.8	5763	30.6	
Hardly ever	1213	7.9	1467	7.8	
Family eating habits at dinner time					<0.001
Proper meal together and usually everyone is at the table	5394	35.4	7292	39.0	
Do not have a proper meal together	6728	44.2	8568	45.8	
Do not have a proper meal	3096	20.3	2856	15.3	
Current smoking habit					<0.001
Daily	5613	37.2	6522	35.6	
Weekly or less than weekly	2249	14.9	2311	12.6	
I have quit smoking	2254	15.0	2543	13.9	
Non-smoking	4955	32.9	6948	37.9	
Mother's smoking					<0.001
Mother never smoked	7587	49.5	9820	51.7	
Mother used to smoke but has now quit	3098	20.2	3968	20.9	
Mother smokes nowadays	4154	27.1	4302	22.6	
I don't know (mother)	486	3.2	915	4.8	
Father's smoking					<0.001
Father never smoked	5259	34.4	7013	36.9	
Father used to smoke but has now quit	4091	26.7	5132	27.0	
Father smokes nowadays	5035	32.9	5624	29.6	
I don't know (father)	921	6.0	1246	6.6	

*) = Chi Square

Supplementary table 2. Formulation of family involvement indicator

Original question	Dichotomized variable
Parent-child relationship	
<i>"If you have difficulties at school or with your school work, how often do you get help"</i>	
Whenever I need	1
On most occasions	1
Rarely	0
Hardly ever	0
<i>"Can you talk about things that concern you with your parents"</i>	
Often	1
Fairly often	1
in and a while	1
Hardly ever	0
Connectedness of family	
<i>"Which of the following alternatives best describes your family's eating habits in the afternoon or evening?"</i>	
Family dinners with usually everyone at the table	1
Have a meal but family does not eat at the same time	0
No proper meal, everyone grabs something to eat	0
Parental monitoring	
<i>"Do your parents know most of your friends?"</i>	
They both know	1
Only my father does	1
Only my mother does	1
Neither does	0
<i>"Do your parents know where you spend your Friday and Saturday nights?"</i>	
Yes, always	1
Yes, sometimes	1
Most of the time they don't know	0

Supplementary table 3. Unadjusted odd ratios (and 95% confidence intervals) in the multinomial logistic regression of smoking on family factors.

	GIRLS									BOYS								
	smokes daily			smokes occasionally			has quit smoking			smokes daily			smokes occasionally			has quit smoking		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age	1.01	0.98-1.05	0.444	0.96	0.92-1.01	0.13	1.05	1.00-1.10	0.045	1.14	1.10-1.18	<0.001	1.06	1.01-1.12	0.024	1.03	0.98-1.09	0.201
Familystructure																		
Other type	2.74	2.48-3.02	<0.001	1.49	1.31-1.69	<0.001	2.17	1.91-2.46	<0.001	2.62	2.33-2.95	<0.001	1.47	1.25-1.74	<0.001	1.50	1.27-1.76	<0.001
Step family	2.18	1.90-2.51	<0.001	1.31	1.09-1.58	0.004	1.57	1.30-1.89	<0.001	1.82	1.61-2.06	<0.001	1.25	1.05-1.49	0.012	1.34	1.14-1.58	<0.001
Single parent	1.92	1.72-2.16	<0.001	1.09	0.93-1.27	0.277	1.52	1.31-1.76	<0.001	1.65	1.49-1.81	<0.001	1.14	0.99-1.30	0.070	1.11	0.97-1.27	0.122
Co-parenting/dual																		
residence	1.57	1.29-1.92	<0.001	1.40	1.10-1.78	0.007	1.37	1.06-1.77	0.015	1.35	1.18-1.54	<0.001	1.19	0.10-1.42	0.055	1.07	0.89-1.27	0.480
Intact	1			1			1			1			1			1		
Mother's education																		
Low	0.99	0.87-1.13	0.841	0.76	0.64-0.91	0.002	0.86	0.72-1.02	0.079	1.18	1.05-1.33	0.005	0.83	0.70-0.98	0.029	0.79	0.67-0.93	0.005
Medium	0.89	0.81-0.99	0.024	0.86	0.76-0.98	0.018	0.88	0.78-1.00	0.058	1.02	0.94-1.11	0.670	0.98	0.88-1.10	0.771	1.02	0.91-1.14	0.762
High	1			1			1			1			1			1		
Father's education																		
Low	1.22	1.07-1.39	0.003	0.92	0.78-1.09	0.345	1.04	0.88-1.23	0.640	1.28	1.14-1.43	<0.001	0.80	0.68-0.93	0.004	0.78	0.68-0.91	0.001
Medium	1.09	0.97-1.22	0.137	0.97	0.84-1.11	0.621	1.08	0.94-1.25	0.288	0.99	0.90-1.09	0.865	0.86	0.76-0.97	0.016	0.81	0.72-0.92	0.001
High	1			1			1			1			1			1		
Parental unemployment																		
One parent	1.66	1.39-1.99	<0.001	1.08	0.85-1.39	0.526	1.08	0.92-1.50	0.199	1.48	1.27-1.73	<0.001	1.01	0.80-1.27	0.938	0.98	0.79-1.23	0.877
Both parents	1.36	1.25-1.48	<0.001	1.04	0.93-1.16	0.520	1.04	1.01-1.27	0.028	1.23	1.14-1.33	<0.001	1.02	0.91-1.13	0.792	1.04	0.94-1.15	0.454
Neither parent	1			1			1			1			1			1		
Parental involvement																		
No involvement	4.47	2.80-7.12	<0.001	3.44	1.94-6.09	<0.001	2.85	1.61-5.05	<0.001	3.59	2.44-5.30	<0.001	1.87	1.06-3.30	0.032	2.11	1.27-3.51	0.004
Very low involvement	2.48	1.99-3.10	<0.001	2.15	1.62-2.86	<0.001	1.39	1.03-1.88	0.033	2.30	1.89-2.81	<0.001	1.41	1.05-1.89	0.022	1.57	1.21-2.04	0.001
Rather low involvement	2.01	1.73-2.33	<0.001	1.87	1.54-2.26	<0.001	1.30	1.07-1.58	0.008	1.80	1.58-2.05	<0.001	1.44	1.20-1.73	<0.001	1.25	1.05-1.49	0.012
Rather high involvement	1.89	1.68-2.13	<0.001	1.74	1.49-2.03	<0.001	1.44	1.24-1.68	<0.001	1.81	1.63-2.00	<0.001	1.48	1.28-1.71	<0.001	1.15	1.00-1.32	0.048
High involvement	1.56	1.40-1.74	<0.001	1.51	1.31-1.74	<0.001	1.26	1.10-1.44	0.001	1.46	1.33-1.60	<0.001	1.39	1.22-1.59	<0.001	1.14	1.01-1.29	0.033
Very high involvement	1			1			1			1			1			1		
Mother's smoking																		
Smokes nowadays	3.36	3.07-3.69	<0.001	1.27	1.12-1.44	<0.001	1.49	1.32-1.68	<0.001	2.54	2.34-2.75	<0.001	1.06	0.95-1.20	0.299	1.11	1.00-1.24	0.084
Used to smoke but has																		
now quit	2.59	2.33-2.88	<0.001	1.55	1.36-1.77	<0.001	1.51	1.32-1.72	<0.001	2.27	2.08-2.49	<0.001	1.34	1.18-1.51	<0.001	1.30	1.15-1.46	<0.001
Never smoked	1			1			1			1			1			1		
Father's smoking																		
Smokes nowadays	2.78	2.54-3.05	<0.001	1.39	1.24-1.57	<0.001	1.54	1.37-1.73	<0.001	2.82	2.60-3.07	<0.001	1.25	1.11-1.39	<0.001	1.29	1.16-1.43	<0.001
Used to smoke but has																		
now quit	2.09	1.89-2.31	<0.001	1.40	1.23-1.58	<0.001	1.41	1.24-1.60	<0.001	2.41	2.20-2.63	<0.001	1.53	1.36-1.72	<0.001	1.49	1.33-1.67	<0.001
Never smoked	1			1			1			1			1			1		

